

**WHAT IS CLAIMED IS:**

1. A breastshield for breastmilk pumping, comprising:

a rigid outer shield part, said outer shield part having an internal funnel-shape with a widened upstream end extending into a tubular portion which terminates in a downstream end, said widened upstream end having a circumferential rim;

a base having a mount within which said downstream end of said outer shield part is received, said base further having a conduit structure formed therein including a milk passageway for milk to flow through said base, a first fluid passageway and a second fluid passageway;

a flexible shield part, said flexible shield part having a shape generally conforming to that of said internal funnel-shape and being received within said outer shield part, said flexible shield part having a longitudinal axis and including an enclosed bladder which presents an internal sidewall around said longitudinal axis defining an interior to the breastshield and which is adapted to receive a nipple and at least some surrounding breast therein in a generally sealing engagement with said flexible shield part;

an expansible area between said bladder and said outer shield part;

a fluid aperture formed in said outer shield part which communicates with said expansible area;

said first fluid passageway communicating with said interior;

said second fluid passageway communicating with said fluid aperture when said outer shield part is mounted on said base.

2. The breastshield of claim 1 wherein said flexible shield part has a circumferential upstream portion which snap-fits on said rim of said outer shield part and a downstream portion which extends around said tubular portion downstream end to thereby form a gasket-like structure for said tubular portion facilitating mounting with said base.

3. The breastshield of claim 2 wherein said first fluid passageway has a first port and said second fluid passageway has a second port, said ports being adapted to be connected with a source of fluid pressure, and said expansible area is separately pressurizable from said interior.

4. The breastshield of claim 3 wherein said widened upstream end of said funnel shape has concavities formed therein, said flexible shield part being pulled into said concavities under the influence of a negative pressure in said expansible area.

5. A breastpump comprising:

a rigid outer shield part, said outer shield part having an internal funnel-shape with a widened upstream end extending into a tubular portion which terminates in a downstream end, said widened upstream end having a circumferential rim;

a base having a mount within which said downstream end of said outer shield part is received, said base further having a conduit structure formed therein including a milk passageway for milk to flow through said base, a first fluid passageway and a second fluid passageway;

a flexible shield part, said flexible shield part having a shape generally conforming to that of said internal funnel-shape and being received within said outer shield part, said flexible shield part having a longitudinal axis and including an enclosed bladder which presents an internal sidewall extending around said longitudinal axis and defining an interior to the breastshield and which is adapted to receive a nipple and at least some surrounding breast therein in a generally sealing engagement with said flexible shield part;

an expansible area between said bladder and said outer shield part;

a fluid aperture formed in said outer shield part which communicates with said expansible area;

said first fluid passageway communicating with said interior;

said second fluid passageway communicating with said fluid aperture when  
said outer shield part is mounted on said base;  
a milk receptacle for receiving milk from said milk passageway of said base;  
a source of fluid pressure communicating with said first and second fluid  
passageways, said source having first and second outputs to said first  
and second fluid passageways respectively which are capable of being  
at different pressures.

6. The breastpump of claim 5 wherein said first output is an intermittent negative  
pressure to draw said nipple and breast further downstream in said interior, and said  
second output is an intermittent positive pressure to move said bladder inwardly relative  
to said interior.

7. A breastpump comprising:  
a rigid outer shield part, said outer shield part having an internal funnel-shape  
with a widened upstream end extending into a tubular portion which  
terminates in a downstream end, said widened upstream end having a  
circumferential rim, said widened upstream end of said funnel shape  
having concavities formed therein which open inboard relative to said  
funnel shape;  
a base part communicating with said downstream end of said outer shield part,  
said base part further having a conduit structure formed therein  
including a milk passageway for milk to flow through said base;  
a first fluid passageway and a second fluid passageway;  
a flexible shield part, said flexible shield part having a shape generally  
conforming to that of said internal funnel-shape and being received  
within said outer shield part, said flexible shield part having a  
longitudinal axis and an internal sidewall extending around said  
longitudinal axis and defining an interior to the breastshield and which  
is adapted to receive a nipple and at least some surrounding breast  
therein in a generally sealing engagement with said flexible shield part;

an expansible area between said flexible shield part and said outer shield part;  
said first fluid passageway communicating with said interior;  
said second fluid passageway communicating with said expansible area;  
a milk receptacle for receiving milk from said milk passageway of said base  
5 part;

a source of fluid pressure communicating with said first and second fluid  
passageways, said source having first and second outputs to said first  
and second fluid passageways respectively which are capable of being  
at different pressures, said flexible shield part being pulled into said  
10 concavities under the influence of a negative pressure in said  
expansible area and being pressed inboard toward said longitudinal axis  
under the influence of a positive pressure in said expansible area.

8. The breastpump of claim 7 wherein said first output is an intermittent  
15 negative pressure to draw said nipple and breast further downstream in said interior, and  
said second output is an intermittent positive pressure alternated with an intermittent  
negative pressure to move said flexible shield part inwardly and outwardly relative to  
said interior.

20 9. A breastshield for a breastpump, comprising:  
a part having an interior longitudinal axis within which at least a portion of a  
woman's breast including a breast nipple is received, said part having a  
flexible area formed thereon, said flexible area having a rest position  
and being capable of moving relative to a breast received within said  
25 conical part, said flexible area having an inboard side facing the breast  
and an outboard side;

first pressure means operating on said flexible area outboard side for moving  
said flexible area cyclically toward and away from said axis, said first  
pressure means generating a positive pressure to press said flexible area  
30 inboard relative to said rest position and toward said axis and a  
negative pressure alternating with said positive pressure to move said

flexible area outboard relative to said rest position and away from said axis; and

second pressure means generating a negative pressure within said interior.

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10. A breastpump comprising:

a rigid outer shield part, said outer shield part having an internal funnel-shape with a widened upstream end extending into a tubular portion which terminates in a downstream end,

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a flexible shield part, said flexible shield part having a shape generally conforming to and extending along the length of said internal funnel-shape and being received within said outer shield part, said flexible shield part having a longitudinal axis and an internal sidewall extending around said longitudinal axis and defining an interior to the breastshield and which is adapted to receive a nipple and at least some surrounding breast therein in a generally sealing engagement with said flexible shield part;

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an expansible area between said flexible shield part and said outer shield part; a fluid aperture formed in said outer shield part which communicates with said expansible area;

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a first fluid passageway communicating with said interior;

a second fluid passageway communicating with said fluid aperture;

a milk receptacle for receiving milk from said milk passageway of said base;

a source of fluid pressure communicating with said first and second fluid passageways, said source having first and second outputs to said first and second fluid passageways respectively which are capable of being at different pressures, said flexible shield part being pulled away from said longitudinal axis under the influence of a negative pressure in said expansible area and being pressed inboard toward said longitudinal axis under the influence of a positive pressure in said expansible area.

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11. The breastpump of claim 10 wherein said first output is an intermittent negative pressure to draw said nipple and breast further downstream in said interior, and said second output is an intermittent positive pressure alternated with an intermittent negative pressure to move said flexible shield part inwardly and outwardly relative to said longitudinal axis.

12. The breastpump of claim 10 wherein said flexible shield part and said outer shield part are integrally molded together.

13. A breastshield for a breastpump comprising:

a rigid outer shield part, said outer shield part having an internal funnel-shape with a widened upstream end extending into a tubular portion which terminates in a downstream end;

a flexible shield part, said flexible shield part having a shape generally conforming to and extending along the length of said internal funnel-shape and being received within said outer shield part, said flexible shield part having a longitudinal axis and an internal sidewall extending around said longitudinal axis and defining an interior to the breastshield and which is adapted to receive a nipple and at least some surrounding breast therein in a generally sealing engagement with said flexible shield part;

an expansible area between said flexible shield part and said outer shield part;

a fluid aperture formed in said outer shield part which communicates with said expansible area;

a first fluid passageway communicating with said interior;

said flexible shield part being pulled away from said longitudinal axis under the influence of a negative pressure in said expansible area and being pressed inboard toward said longitudinal axis under the influence of a positive pressure in said expansible area.

14. The breastpump of claim 13 wherein said flexible shield part and said outer shield part are integrally molded together.

15. A breastshield for a breastpump, comprising:

- 5           a base member, said base member having a port through which air and milk  
            can pass;
- a breast receptacle mounted on said base, said breast receptacle having an  
            expansible chamber with an inner flexible sidewall which further forms  
            an interior space adapted to receive at least a portion of a woman's  
10           breast including the nipple therein, said breast receptacle being formed  
            in a single piece having a u-shaped cross-section from top to bottom,  
            with an inner shield part, an outer shield part spaced from said inner  
            shield part and a smoothly curved top transition part, said inner, outer  
            and top parts defining said expansible chamber surrounding said  
15           interior space;
- a first port formed in one of said base and said breast receptacle in  
            communication with an interior of said chamber for connection with a  
            source of fluid pressure;
- a second port formed in one of said base and said breast receptacle in  
20           communication with said expansible chamber for communication with  
            said source of fluid pressure.

25           16. The breastshield of claim 15, wherein said single piece of said breast  
            receptacle has an outer shield part with a greater wall thickness than said inner flexible  
            sidewall, such that said outer shield part is relatively rigid compared to said inner flexible  
            sidewall.

30           17. The breastshield of claim 15, wherein said single piece of said breast  
            receptacle is initially formed as a flexible-walled member enclosing an interior region  
            with opposed first and second end openings to said interior space, and said breast

receptacle is then provided by causing said first end to be inverted into said interior region and then placed within said second end.

18. A breastshield for a breastpump, comprising:

- 5 a base member, said base member having a port through which air and milk can pass;
- a breast receptacle mounted on said base, said breast receptacle having an expansible chamber with an inner flexible sidewall which further forms an interior space adapted to receive at least a portion of a woman's breast including the nipple therein, said breast receptacle being formed in a single piece having a teardrop-shaped cross-section from top to bottom, with an inner shield part, an outer shield part spaced from said inner shield part and a smoothly curved top transition part, said inner, outer and top parts defining said expansible chamber surrounding said interior space;
- 15 a first port formed in one of said base and said breast receptacle in communication with an interior of said expansible chamber for connection with a source of fluid pressure;
- a second port formed in one of said base and said breast receptacle in communication with said expansible chamber for communication with said source of fluid pressure.
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19. The breastshield of claim 18, wherein said single piece of said breast receptacle is initially formed as a flexible-walled member enclosing an interior region with opposed first and second end openings to said interior space, and said breast receptacle is then provided by causing said first end to be inverted into said interior region and then placed within said second end.

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20. The breastshield of claim 18 wherein said breast receptacle part is formed from a single piece of flexible material which yields an outboard circumferential sidewall extending into a smoothly curved forward wall and then extending into an inboard

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circumferential sidewall, said sidewalls being spaced from each other to form said expansible chamber, said forward wall defining an opening into said interior formed by said inboard circumferential sidewall, said sidewalls terminating in a rearward wall end structure which is mounted to said base member.

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21. The breastshield of claim 20 wherein said rearward wall end structure is removably mounted to said base member.

10 22. The breastshield of claim 21 wherein said rearward wall end structure is an open ring-shaped channel formed by spacing said sidewalls apart, said base member having a ring-shaped collar which is received in said ring-shaped channel and upon which said receptacle part is thereby sealably mounted.

15 23. The breastshield of claim 21 wherein said rearward wall end structure is formed by bringing said sidewalls together to form a ring, said base member having a ring-shaped well within which is received said ring to thereby sealably mount said receptacle part to said base member.

20 24. The breastshield of claim 23 wherein a gap is left between said sidewalls in at least a part of said ring, said base member having said first port formed therein and extending into said well to communicate with said expansible chamber through said gap.

25 25. The breastshield of claim 23 wherein said base member has said first port formed therein extending through said collar to communicate with said expansible chamber through said ring-shaped channel.

30 26. The breastshield of claim 15 wherein a valve is provided between said pressure source and said first port, said valve having a first position for maintaining a desired pressure level within said expansible chamber and a second position for releasing said pressure level.

27. The breastshield of claim 18 wherein a valve is provided between said pressure source and said first port, said valve having a first position for maintaining a desired pressure level within said expansible chamber and a second position for releasing said pressure level.

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28. A breastshield having a breast receptacle part formed from a single piece of flexible material which yields an outboard circumferential sidewall extending into a smoothly curved forward wall and then extending into an inboard circumferential sidewall, said sidewalls being spaced from each other to form said expansible chamber, said forward wall defining an opening into said interior formed by said inboard circumferential sidewall, said sidewalls terminating in a rearward wall end structure which is mounted to a base part.

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29. The breastshield of claim 28 wherein said rearward wall end structure is removably mounted to said base part.

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30. The breastshield of claim 29 wherein said rearward wall end structure is an open ring-shaped channel formed by spacing said sidewalls apart, said base part having a ring-shaped collar which is received in said ring-shaped channel and upon which said receptacle part is thereby sealably mounted.

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31. The breastshield of claim 29 wherein said rearward wall end structure is formed by bringing said sidewalls together to form a ring, said base part having a ring-shaped well within which is received said ring to thereby sealably mount said receptacle part to said base part.

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32. The breastshield of claim 31 wherein a gap is left between said sidewalls in at least a part of said ring, said base part having said first port formed therein and extending into said well to communicate with said expansible chamber through said gap.

33. The breastshield of claim 32 wherein said base part has said vacuum port formed therein extending through said collar to communicate with said expansible chamber through said ring-shaped channel.

5           34. The breastshield of claim 28 further including a chamber port communicating with said chamber for connection of a source of positive pressure thereto to expand said chamber, and further including a valve between said source of positive pressure and said chamber port, said valve having a first position for maintaining a desired pressure level within said expansible chamber and a second position for releasing  
10       said pressure level.

35. A breastshield for breastmilk pumping, comprising:  
a rigid outer shield part, said outer shield part having left and right portions which join together;  
15       an inner shield part mounted within said outer shield part, said inner shield part forming an inner sidewall to the breastshield and defining an interior adapted to receive therein and surround at least some of a woman's breast including a nipple in a substantially airtight engagement with the breast;  
20       a flexible area formed on said inner shield part, said flexible area capable of movement relative to a breast received within said breastshield;  
a first space defined between said flexible area and said outer shield part;  
a first port communicating with said first space to connect a source of fluid  
25       pressure to said space whereby application of a source of positive fluid pressure to said first space causes said space to expand to thereby move said flexible area,  
a second port communicating with said interior, whereby application of a source of negative pressure to said interior causes the breast to be  
30       pulled further into said interior.

36. The breastshield of claim 35 wherein a conduit is formed within said outer shield part to communicate pressure to said first space.

37. The breastshield of claim 36 further comprising a second space defined between said flexible area and said outer shield part, said second space being located downstream relative to the breast and said first space, said second space being isolated relative to said first space, said second port communicating with said second space to connect a source of fluid pressure to said second space, wherein said first and second spaces are capable of expanding and contracting independently of each other.

38. The breastshield of claim 37 further comprising a third space defined between said flexible area and said outer shield part, said third space being located downstream from said first and second spaces and being isolated relative to said first and second spaces, and a third port communicating with said third space, whereby application of a source of either positive or negative pressure causes said third space to respectively expand or contract independently of said other spaces.

39. The breastshield of claim 38 wherein said third space is an elongated section of said flexible area which extends into said interior, said elongated section being acted upon by a negative pressure applied outboard relative to said elongated section to thereby move away from said interior and thereby generate a negative pressure within said interior while also serving to isolate said source of negative pressure from milk expressed within said interior.

40. The breastshield of claim 35 wherein said left and right portions engage in a clamshell arrangement around said inner shield part and are releasably connected to enable removal of said inner shield part from said outer shield part.